

CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: July 22, 2020

TO: Lisa Lumley – NER

FROM: Wade Strickland – WY/3 *Deane F. Strickland for WY*

SUBJECT: Water Quality-Based Effluent Limitations for the Wild Rose Wastewater Treatment Facility
WPDES Permit No. WI-0060071-09

This is in response to your request for an evaluation of the need for water quality-based effluent limitations (WQBELs) using Chapters NR 102, 104, 105, 106, 207, 210, 212, and 217 of the Wisconsin Administrative Code (where applicable), for the discharge from the Wild Rose Wastewater Treatment Facility in Waushara County. This municipal wastewater treatment facility (WWTF) discharges to the Pine River, located in the Pine and Willows River Watershed in the Wolf River Basin. This discharge is included in the Upper Fox and Wolf River Basin TMDL as approved by EPA. The evaluation of the permit recommendations is discussed in more detail in the attached report.

Based on our review, the following recommendations are made on a chemical-specific basis at Outfall 002:

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Six-Month Average	Footnotes
Flow Rate						1,2
BOD ₅			45 mg/L	30 mg/L		1
TSS			183 lbs/day	60 mg/L 112 lbs/day		3,4
pH	9.0 s.u.	6.0 s.u.				1
Ammonia Nitrogen April & May	Variable		68 mg/L 60 lbs/day	26 mg/L 23 lbs/day		5,6,7
June – September	Variable		72 mg/L 63 lbs/day	72 mg/L 63 lbs/day		
October – March	Variable		72 mg/L 63 lbs/day	29 mg/L 25 lbs/day		
Bacteria						8
Interim Limit Fecal Coliform				400 #/100 mL geometric mean		
Final Limit <i>E. coli</i>				126 #/100 mL geometric mean		
Phosphorus Interim TMDL				2.9 mg/L 0.562 lbs/day	0.188 lbs/day	3,9
Nitrite + Nitrate						2,10
Nitrogen, Total Kjeldahl						2,10
Total Nitrogen						2,10
Acute WET						11,12
Chronic WET						11,12

Footnotes:

1. No changes from the current permit

2. Monitoring only
3. The TSS and phosphorus mass limits are based on the Total Maximum Daily Load (TMDL) for the Upper Fox and Wolf River Basin to address phosphorus water quality impairments within the TMDL area. The TMDL was approved by EPA in February 2020.
4. The TSS concentration limit is a variance limit based on s. NR 210.07(2) for aerated lagoons.
5. Additional limits to comply with the expression of limits requirements in ss. NR 106.07 and NR 205.065(7) are included in bold.
6. The variable daily maximum ammonia nitrogen limit table corresponding to various effluent pH values may be included in the permit in place of the single limit. These limits apply year-round.


Effluent pH s.u.	Limit mg/L	Effluent pH s.u.	Limit mg/L	Effluent pH s.u.	Limit mg/L
6.0 ≤ pH ≤ 6.1	72	7.0 < pH ≤ 7.1	44	8.0 < pH ≤ 8.1	9.3
6.1 < pH ≤ 6.2	71	7.1 < pH ≤ 7.2	39	8.1 < pH ≤ 8.2	7.6
6.2 < pH ≤ 6.3	69	7.2 < pH ≤ 7.3	35	8.2 < pH ≤ 8.3	6.3
6.3 < pH ≤ 6.4	67	7.3 < pH ≤ 7.4	31	8.3 < pH ≤ 8.4	5.2
6.4 < pH ≤ 6.5	65	7.4 < pH ≤ 7.5	27	8.4 < pH ≤ 8.5	4.3
6.5 < pH ≤ 6.6	63	7.5 < pH ≤ 7.6	23	8.5 < pH ≤ 8.6	3.5
6.6 < pH ≤ 6.7	60	7.6 < pH ≤ 7.7	19	8.6 < pH ≤ 8.7	3.0
6.7 < pH ≤ 6.8	56	7.7 < pH ≤ 7.8	16	8.7 < pH ≤ 8.8	2.5
6.8 < pH ≤ 6.9	52	7.8 < pH ≤ 7.9	14	8.8 < pH ≤ 8.9	2.1
6.9 < pH ≤ 7.0	48	7.9 < pH ≤ 8.0	11	8.9 < pH ≤ 9.0	1.8

7. The ammonia nitrogen mass limits are required because this is a discharge to an exceptional resource water (s. NR 106.32(5)(b))
8. Bacteria limits apply during the disinfection season of May through September. The fecal coliform interim limit will apply until the end of the compliance schedule when *E. coli* limits take effect. Additional final limit: No more than 10 percent of *E. coli* bacteria samples collected in any calendar month may exceed 410 count/100 mL.
9. The monthly average phosphorus limit is a technology-based limit which also functions as an interim limit for the phosphorus compliance schedule.
10. As recommended in the Department's October 1, 2019 Guidance for Total Nitrogen Monitoring in Wastewater Permits, annual total nitrogen (total kjeldahl nitrogen and nitrate/nitrite) monitoring is recommended for all minor municipal permittees. Total Nitrogen is the sum of nitrate (NO₃), nitrite (NO₂), and total kjeldahl nitrogen (all expressed as N).
11. After consideration of the guidance provided in the Department's WET Program Guidance Document (2019) and other information described in the WET section, three acute and two chronic WET tests are recommended in the reissued permit. Tests should be done in rotating quarters to collect seasonal information about this discharge. WET testing should continue after the permit expiration date (until the permit is reissued). The Instream Waste Concentration (IWC) to assess chronic test results is 8%. According to the *State of Wisconsin Aquatic Life Toxicity Testing Methods Manual* (s. NR 219.04, Table A, Wis. Adm. Code), chronic testing shall be performed using a dilution series of 100%, 75%, 50%, 25% & 12.5% and the dilution water used in WET tests conducted on Outfall 002 shall be a grab sample collected from the Pine River.
12. Sampling WET concurrently with any chemical-specific toxic substances is recommended. Tests should be done in rotating quarters, to collect seasonal information about this discharge and should continue after the permit expiration date (until the permit is reissued).

Please consult the attached report for details regarding the above recommendations. If there are any questions or comments, please contact Nicole Krueger at Nicole.Krueger@wisconsin.gov or Diane Figiel at Diane.Figiel@wisconsin.gov.

Attachments (3) – Narrative, Outfall Map, & Thermal Table

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Water Quality-Based Effluent Limitations for the Wild Rose Wastewater Treatment Facility

WPDES Permit No. WI-0060071-09

Prepared by: Nicole Krueger

PART 1 – BACKGROUND INFORMATION

Facility Description:

The Village of Wild Rose in central Waushara County owns and operates a three Aerated Lagoon wastewater treatment facility (WWTF). Influent first passes through a mechanical flight type fine grit screening device and from there enters the aerated lagoons. The lagoons are oriented such that wastewater passes through them in series. Each lagoon is aerated, the first lagoon has 28 EDI diffusers, the second has nine EDI diffusers and the third has three diffusers. Disinfection changed from chlorination to UV disinfection three years ago.

Attachment #2 is a map of the area showing the approximate location of Outfall 002.

Existing Permit Limitations: The current permit, expiring on 06/30/2020, includes the following effluent limitations and monitoring requirements.

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Six-Month Average	Footnotes
Flow Rate						1
BOD ₅			45 mg/L	30 mg/L		2
TSS				60 mg/L		3
pH	9.0 s.u.	6.0 s.u.				2
Ammonia Nitrogen Year – round March	Variable			34 mg/L 33 lbs/day		4
Residual Chlorine May – September	38 µg/L					5
Fecal Coliform May – September				400#/100 mL geometric mean		
Phosphorus				2.9 mg/L 2.8 lbs/day		6
Acute WET						7
Chronic WET						7

Footnotes:

1. Monitoring only
2. These limitations are not being evaluated as part of this review. Because the water quality criteria (WQC), reference effluent flow rates, and receiving water characteristics have not changed, limitations for these water quality characteristics do not need to be re-evaluated at this time.
3. The TSS concentration limit is a variance limit based on s. NR 210.07(2) for aerated lagoons.

4. Ammonia daily maximum variable limits table

Effluent pH - s.u.	NH ₃ -N Limit – mg/L	Effluent pH - s.u.	NH ₃ -N Limit – mg/L
pH ≤ 6.7	No Limit	7.8 < pH ≤ 7.9	14
6.7 < pH ≤ 6.8	56	7.9 < pH ≤ 8.0	11
6.8 < pH ≤ 6.9	52	8.0 < pH ≤ 8.1	9.3
6.9 < pH ≤ 7.0	48	8.1 < pH ≤ 8.2	7.6
7.0 < pH ≤ 7.1	44	8.2 < pH ≤ 8.3	6.3
7.1 < pH ≤ 7.2	39	8.3 < pH ≤ 8.4	5.2
7.2 < pH ≤ 7.3	35	8.4 < pH ≤ 8.5	4.3
7.3 < pH ≤ 7.4	31	8.5 < pH ≤ 8.6	3.5
7.4 < pH ≤ 7.5	27	8.6 < pH ≤ 8.7	3.0
7.5 < pH ≤ 7.6	23	8.7 < pH ≤ 8.8	2.5
7.6 < pH ≤ 7.7	19	8.8 < pH ≤ 8.9	2.1
7.7 < pH ≤ 7.8	16	8.9 < pH ≤ 9.0	1.8

- Chlorine has been replaced by UV for disinfection.
- The phosphorus limits which became effective January 1, 2020 are water quality based effluent limits using the procedures in s. NR 217.13. The interim limit prior to that was 6.3 mg/L as a monthly average.
- Acute and chronic WET tests were to be completed once every other year. The instream waste concentration (IWC) for chronic tests is 11.4%. The dilution series for acute testing is 100, 50, 25, 12.5, and 6.25% and the dilution series for chronic testing is 100, 30, 10, 3, and 1%.

Receiving Water Information:

- Name: Pine River
- Classification used in accordance with chs. NR 102 and 104, Wis. Adm. Code: Coldwater community, nonpublic water supply. The receiving water is classified as a Class 1 Trout Stream and an exceptional resource water, per s. NR 102.11(1)(b), Wis. Adm. Code. (Cold Water and Public Water Supply criteria are used for bioaccumulating compounds of concern, because the discharge is within the Great Lakes basin.)
- Low Flows used in accordance with chs. NR 106 and 217, Wis. Adm. Code: The following 7-Q₁₀ and 7-Q₂ values are from USGS for Station #04081408, where Outfall 002 is located. These flows were updated in July 2008.

7-Q₁₀ = 7.4 cfs (cubic feet per second)

7-Q₂ = 8.4 cfs

90-Q₁₀ = 7.9 cfs

Harmonic Mean Flow = cfs using a drainage area of 27.1 mi²

The Harmonic Mean has been estimated based on average flow and the 7-Q₁₀ using an equation from U.S. EPA's *Technical Support Document for Water Quality-Based Toxics Control* (March 1991, EPA/505/2-90-001, pgs. 88-89).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
7-Q ₁₀ (cfs)	7.6	7.4	7.6	10.1	10.3	9.4	8.6	8.1	8.1	8.1	8.4	7.8
7-Q ₂ (cfs)	8.8	8.6	9.4	11.7	11.3	10.8	10.1	9.5	9.4	9.5	9.8	9.3

Attachment #1

- Hardness = 242 mg/L as CaCO₃. This value represents the geometric mean of data from WET tests from 09/12/2006 to 11/07/2017.
- % of low flow used to calculate limits in accordance with s. NR 106.06 (4) (c) 5., Wis. Adm. Code: 25%
- Source of background concentration data: Metals data from Chaffee Creek at Dakota has been used in the following evaluation. The ecological landscape at Dakota is similar and water quality characteristics are therefore assumed to also be similar. Background chloride data is from the Pine River at Highway A, just upstream of outfall 002.
- Multiple dischargers: The Wild Rose Fish Hatchery operated by WDNR, discharges to the Pine River approximately ½ mile downstream from Outfall 002. This discharge is not considered to be significant in this evaluation.
- Impaired water status: The immediate receiving water is not impaired. Poygan Lake approximately 20 miles downstream from the Wild Rose outfall is listed as impaired for PCBs, total phosphorus, and total suspended solids.

Effluent Information:

- Design Flow Rate(s):
Annual average = 0.105 MGD (Million Gallons per Day)
For reference, the actual average flow from 07/01/2015 to 02/29/2020 was 0.07 MGD.
- Hardness = 224 mg/L as CaCO₃. This value represents the geometric mean of data from 12/13/2019 to 12/24/2019 from the permit reissuance application.
- Acute dilution factor used in accordance with s. NR 106.06 (3) (c), Wis. Adm. Code: Not applicable – this facility does not have an approved Zone of Initial Dilution (ZID).
- Water Source: Domestic wastewater with water supply from wells
- Additives: None.
- Effluent characterization: This facility is categorized as a minor municipality, so the permit application required effluent sample analyses for a limited number of common pollutants, as specified in s. NR 200.065, Table 1, Wis. Adm. Code, primarily metal substances plus Ammonia, Chloride, Hardness and Phosphorus.

Sample Date	Chloride mg/L
12/13/2019	214
12/17/2019	225
12/20/2019	225
12/24/2019	232
Average	224

	Copper µg/L
1-day P ₉₉	13.7
4-day P ₉₉	11.7
30-day P ₉₉	10.5
Mean	9.90
Std	1.44
Sample size	11
Range	8.75 – 13.6

Attachment #1

Effluent data for substances for which a single sample was analyzed is shown in the tables in Part 2 below, in the column titled “MEAN EFFL. CONC.”.

The following table presents the average concentrations and loadings at Outfall 002 from 07/01/2015 to 02/29/2020 for all parameters with limits in the current permit to meet the requirements of s. NR 201.03(6):

	Average Measurement	Average Mass Discharged
BOD ₅	10.4 mg/L*	
TSS	10.0 mg/L	
pH field	7.50 s.u.	
Phosphorus	4.89 mg/L	
Ammonia Nitrogen	9.03 mg/L	42.4 lbs/day
Fecal Coliform	17.5 #/100mL*	
Chlorine, Total Residual	49.5 µg/L*	

*Results below the level of detection (LOD) were included as zeroes in calculation of average.

PART 2 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR TOXIC SUBSTANCES – EXCEPT AMMONIA NITROGEN

Permit limits for toxic substances are required whenever any of the following occur:

1. The maximum effluent concentration exceeds the calculated limit (s. NR 106.05(3), Wis. Adm. Code)
2. If 11 or more detected results are available in the effluent, the upper 99th percentile (or P₉₉) value exceeds the comparable calculated limit (s. NR 106.05(4), Wis. Adm. Code)
3. If fewer than 11 detected results are available, the mean effluent concentration exceeds 1/5 of the calculated limit (s. NR 106.05(6), Wis. Adm. Code)

Acute Limits based on 1-Q₁₀

Daily maximum effluent limitations for toxic substances are based on the acute toxicity criteria (ATC), listed in ch. NR 105, Wis. Adm. Code. Previously daily maximum limits for toxic substances were calculated as two times the ATC. However, changes to ch. NR 106, Wis. Adm. Code (September 1, 2016) require the Department to calculate acute limitations using the same mass balance equation as used for other limits along with the 1-Q₁₀ receiving water low flow to determine if more restrictive effluent limitations are needed to protect the receiving stream from discharges which may cause or contribute to an exceedance of the acute water quality standards.

$$\text{Limitation} = \frac{(\text{WQC}) (Q_s + (1-f) Q_e) - (Q_s - f Q_e) (C_s)}{Q_e}$$

Where:

WQC = Acute toxicity criterion or secondary acute value according to ch. NR 105

Q_s = average minimum 1-day flow which occurs once in 10 years (1-day Q₁₀)

if the 1-day Q₁₀ flow data is not available = 80% of the average minimum 7-day flow which occurs once in 10 years (7-day Q₁₀).

Q_e = Effluent flow (in units of volume per unit time) as specified in s. NR 106.06(4)(d), Wis. Adm. Code.

Attachment #1

f = Fraction of the effluent flow that is withdrawn from the receiving water, and

Cs = Background concentration of the substance (in units of mass per unit volume) as specified in s. NR 106.06(4)(e), Wis. Adm. Code.

If the receiving water is effluent dominated under low stream flow conditions, the 1-Q₁₀ method of limit calculation produces the most stringent daily maximum limitations and should be used while making reasonable potential determinations. This is not the case for Wild Rose and the limits are set based on two times the acute toxicity criteria.

The following tables list the calculated water quality-based effluent limitations for this discharge along with the results of effluent sampling for all the detected substances. All concentrations are expressed in terms of micrograms per Liter (µg/L), except for hardness and chloride (mg/L).

Daily Maximum Limits based on Acute Toxicity Criteria (ATC)

RECEIVING WATER FLOW = 5.92 cfs, (1-Q₁₀ (estimated as 80% of 7-Q₁₀)), as specified in s. NR 106.06 (3) (bm), Wis. Adm. Code.

SUBSTANCE	REF. HARD.* mg/L	ATC	MEAN BACK- GRD.	MAX. EFFL. LIMIT**	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	1-day P ₉₉	1-day MAX. CONC.
Arsenic		340		680	140	<0.53		
Cadmium	234	11.5	0.55	23.1	4.60	<0.067		
Chromium	234	3614	0.27	7227	1445	<0.92		
Copper	234	34.6	2.27	69.1			13.7	13.6
Lead	234	243		486	97.1	0.96		
Nickel	234	962	7.90	1920	385	1.44		
Zinc	234	253	15.8	506	101	<30		
Chloride (mg/L)		757	3	1510	303	224		

* * The 2 × ATC method of limit calculation yields a more restrictive limit than consideration of ambient concentrations and 1-Q₁₀ flow rates per the changes to s. NR 106.07(3), Wis. Adm. Code, effective 09/01/2016.

Weekly Average Limits based on Chronic Toxicity Criteria (CTC)

RECEIVING WATER FLOW = 1.85 cfs (¼ of the 7-Q₁₀), as specified in s. NR 106.06 (4) (c), Wis. Adm. Code

SUBSTANCE	REF. HARD.* mg/L	CTC	MEAN BACK- GRD.	WEEKLY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	4-day P ₉₉
Arsenic		148		1830	367	<0.53	
Cadmium	175	3.82	0.55	41.1	8.20	<0.067	
Chromium	242	177.78	0.27	2199.0	439.80	<0.92	
Copper	242	22.05	2.27	247.3			11.7
Lead	242	65.78		814.8	163.0	0.96	
Nickel	242	110.24	7.90	1276	255.1	1.44	
Zinc	242	260.73	15.8	3050	610.0	<30	
Chloride (mg/L)		395	3	4860	972	224	

* The indicated hardness may differ from the receiving water hardness because the receiving water hardness exceeded the maximum range in ch. NR 105, Wis. Adm. Code, over which the chronic criteria are applicable. In that case, the maximum of the range is used to calculate the criterion.

Monthly Average Limits based on Wildlife Criteria (WC)

The effluent characterization did not include any effluent sampling results for substances for which Wildlife Criteria exist.

Monthly Average Limits based on Human Threshold Criteria (HTC)

RECEIVING WATER FLOW = 3.5544 cfs (¼ of Harmonic Mean), as specified in s. NR 106.06 (4), Wis. Adm. Code.

SUBSTANCE	HTC	MEAN BACK- GRD.	MO'LY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.
Cadmium	370	0.55	8453	1691	<0.067
Chromium (+3)	3818000	0.27	87350000	17470000	<0.92
Lead	140		3203	640.6	0.96
Nickel	43000	7.90	980000	20000	1.44

Monthly Average Limits based on Human Cancer Criteria (HCC)

RECEIVING WATER FLOW = 3.5544 cfs (¼ of Harmonic Mean), as specified in s. NR 106.06 (4), Wis. Adm. Code.

SUBSTANCE	HCC	MO'LY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.
Arsenic	13.3	304	60.9	<0.53

In addition to evaluating the need for limits for each individual substance for which HCC exist, s. NR 106.06(8), Wis. Adm. Code, requires the evaluation of the cumulative cancer risk. Because no effluent limits are needed based on HCC, determination of the cumulative cancer risk is not needed per s. NR 106.06(8), Wis. Adm. Code.

Conclusions and Recommendations: Based on a comparison of the effluent data and calculated effluent limitations, no effluent limitations are required.

Mercury – The permit application did not require monitoring for mercury because Wild Rose is categorized as a minor facility as defined in s. NR 200.02(8), Wis. Adm. Code. In accordance with s. NR 106.145(3)(a)3., Wis. Adm. Code, a minor municipal discharger shall monitor, and report results of influent and effluent mercury monitoring once every three months if, “there are two or more exceedances in the last five years of the high-quality sludge mercury concentration of 17 mg/kg specified in s. NR 204.07(5).” Because this is a lagoon facility, sludge is not land applied very often, so all available data was A review of the past twenty years of sludge characteristics data reveals that all the sample results are within expected analytical ranges and well below the 17 mg/kg level. The average concentration in the sludge from 06/11/2001 to 03/26/2007 was 8.1 mg/kg, with a maximum reported concentration of 11 mg/kg. Therefore, no mercury monitoring is recommended at Outfall 002.

PART 3 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR AMMONIA NITROGEN

The State of Wisconsin promulgated revised water quality standards for ammonia nitrogen in ch. NR 105, Wis. Adm. Code, effective March 1, 2004 which includes criteria based on both acute and chronic toxicity to aquatic life. The current permit has daily maximum year round and monthly average limit for March. These limits are re-evaluated at this time due to the following changes:

- Subchapter IV of ch. NR 106, Wis. Adm. Code allows limits based on available dilution instead of limits set to twice the acute criteria.
- Section NR 106.07(3), Wis. Adm. Code requires weekly and monthly average limits for municipal treatment plants.
- The maximum expected effluent pH has changed

Daily Maximum Limits based on Acute Toxicity Criteria (ATC):

Daily maximum limitations are based on acute toxicity criteria in ch. NR 105, Wis. Adm. Code, which are a function of the effluent pH and the receiving water classification. The acute toxicity criterion (ATC) for ammonia is calculated using the following equation.

$$\text{ATC in mg/L} = [A \div (1 + 10^{(7.204 - \text{pH})})] + [B \div (1 + 10^{(\text{pH} - 7.204)})]$$

Where:

A = 0.275 and B = 39.0 for a Cold-Water Category 1 fishery, and
pH (s.u.) = that characteristic of the effluent.

The effluent pH data was examined as part of this evaluation. A total of 711 sample results were reported from 07/06/2015 to 02/26/2020. The maximum reported value was 8.56 s.u. (Standard pH Units). The effluent pH was 8.20 s.u. or less 99% of the time. The 1-day P₉₉, calculated in accordance with s. NR 106.05(5), Wis. Adm. Code, is 8.21 s.u. and the mean plus the standard deviation multiplied by a factor of 2.33, an estimate of the upper ninety ninth percentile for a normally distributed dataset, is 8.18 s.u. Therefore, a value of 8.20 s.u. is believed to represent the maximum reasonably expected pH, and therefore most appropriate for determining daily maximum limitations for ammonia nitrogen. Substituting a value of 8.20 s.u. into the equation above yields an ATC = 3.83 mg/L.

Potential changes to daily maximum Ammonia Nitrogen effluent limitations:

Subchapter IV of ch. NR 106, Wis. Adm. Code (effective September 1, 2016) specifies methods for the use of the 1-Q₁₀ receiving water low flow to calculate daily maximum ammonia nitrogen limits if it is determined that the previous method of acute ammonia limit calculation (2×ATC) is not sufficiently protective of the fish and aquatic life. The more restrictive calculated limits shall apply.

The calculated daily maximum ammonia nitrogen effluent limits using the mass balance approach with the 1-Q₁₀ (estimated as 80 % of 7-Q₁₀) and the 2×ATC approach are shown below.

	Ammonia Nitrogen Limit mg/L
2×ATC	7.65
1-Q ₁₀	142

The 2×ATC method yields the most stringent limits for Wild Rose.

The current permit has variable daily maximum effluent limits based on effluent pH. Presented below is a table of daily maximum limitations corresponding to the range of allowable effluent pH values.

Daily Maximum Ammonia Nitrogen Limits – Cold water

Effluent pH s.u.	Limit mg/L	Effluent pH s.u.	Limit mg/L	Effluent pH s.u.	Limit mg/L
$6.0 \leq \text{pH} \leq 6.1$	72	$7.0 < \text{pH} \leq 7.1$	44	$8.0 < \text{pH} \leq 8.1$	9.3
$6.1 < \text{pH} \leq 6.2$	71	$7.1 < \text{pH} \leq 7.2$	39	$8.1 < \text{pH} \leq 8.2$	7.6
$6.2 < \text{pH} \leq 6.3$	69	$7.2 < \text{pH} \leq 7.3$	35	$8.2 < \text{pH} \leq 8.3$	6.3
$6.3 < \text{pH} \leq 6.4$	67	$7.3 < \text{pH} \leq 7.4$	31	$8.3 < \text{pH} \leq 8.4$	5.2
$6.4 < \text{pH} \leq 6.5$	65	$7.4 < \text{pH} \leq 7.5$	27	$8.4 < \text{pH} \leq 8.5$	4.3
$6.5 < \text{pH} \leq 6.6$	63	$7.5 < \text{pH} \leq 7.6$	23	$8.5 < \text{pH} \leq 8.6$	3.5
$6.6 < \text{pH} \leq 6.7$	60	$7.6 < \text{pH} \leq 7.7$	19	$8.6 < \text{pH} \leq 8.7$	3.0
$6.7 < \text{pH} \leq 6.8$	56	$7.7 < \text{pH} \leq 7.8$	16	$8.7 < \text{pH} \leq 8.8$	2.5
$6.8 < \text{pH} \leq 6.9$	52	$7.8 < \text{pH} \leq 7.9$	14	$8.8 < \text{pH} \leq 8.9$	2.1
$6.9 < \text{pH} \leq 7.0$	48	$7.9 < \text{pH} \leq 8.0$	11	$8.9 < \text{pH} \leq 9.0$	1.8

Weekly and Monthly Average Limits based on Chronic Toxicity Criteria (CTC)

The ammonia limit calculation also warrants evaluation of weekly and monthly average limits based on chronic toxicity criteria for ammonia, since those limits relate to the assimilative capacity of the receiving water.

Weekly average and monthly average limits for ammonia nitrogen are based on chronic toxicity criteria in ch. NR 105, Wis. Adm. Code.

The 30-day chronic toxicity criterion (CTC) for ammonia in waters classified for a Cold-Water Community is calculated by the following equation, according to subchapter IV of NR 106, Wis. Adm. Code.

$$\text{CTC} = E \times \{ [0.0676 \div (1 + 10^{(7.688 - \text{pH})})] + [2.912 \div (1 + 10^{(\text{pH} - 7.688)})] \} \times C$$

Where:

pH = the pH (s.u.) of the receiving water,

E = 0.854,

C = the minimum of 2.85 or $1.45 \times 10^{(0.028 \times (25 - T))}$,

T = the temperature (°C) of the receiving water

The 4-day criterion is equal to the 30-day criterion multiplied by 2.5. The 4-day criteria are used in a mass-balance equation with the 7-Q₁₀ (4-Q₃, if available) to derive weekly average limitations. And the 30-day criteria are used with the 30-Q₅ (estimated as 85% of the 7-Q₂ if the 30-Q₅ is not available) to derive monthly average limitations. The stream flow value is further adjusted to temperature; 100% of the flow is used if the Temperature ≥ 16 °C, 25% of the flow is used if the Temperature < 11 °C, and 50% of the flow is used if the Temperature ≥ 11 °C but < 16 °C.

Since minimal ambient data is available, the “default” basin assumed values are used for Temperature, pH and background ammonia concentrations, shown in the table below, with the resulting criteria and effluent limitations.

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		Spring	Summer	Winter
		April & May	June – Sept.	Oct. - March
Effluent Flow	Qe (MGD)	0.105	0.105	0.105
Background Information	7-Q ₁₀ (cfs)	7.40	7.40	7.40
	7-Q ₂ (cfs)	8.40	8.40	8.40
	Ammonia (mg/L)	0.04	0.03	0.07
	Maximum Temperature (°C)	13	18	9
	Average Temperature (°C)	11	16	4
	pH (s.u.)	8.06	8.08	7.99
	% of Flow used	25	100	25
	Reference Weekly Flow (cfs)	1.85	7.4	1.85
	Reference Monthly Flow (cfs)	1.785	7.14	1.785
Criteria mg/L	4-day Chronic	5.55	4.37	6.15
	30-day Chronic	2.22	1.75	2.46
Effluent Limits mg/L	Weekly Average	68.3	202	75.4
	Monthly Average	26.2	77.3	28.7

Section NR 106.33(2), Wis. Adm. Code, was updated effective September 1, 2016. As a result, seasonal 20 and 40 mg/L thresholds for including ammonia limits in municipal discharge permits are no longer applicable under current rules. Section NR 106.33(1), Wis. Adm. Code, enables the Department to determine the need to include ammonia limits in municipal discharge permits based on the statistical comparisons in s. NR 106.05, Wis. Adm. Code. The previous WQBEL memo recommended a monthly average limit of 34 mg/L for March because the rest of the months had calculated limits greater than the 20 mg/L threshold.

Effluent Data

The following table evaluates the statistics based upon ammonia data reported from 07/06/2015 to 02/24/2020, with those results being compared to the calculated limits to determine the need to include ammonia limits in the Wild Rose permit for the respective month ranges. That need is determined by calculating 99th upper percentile (or P₉₉) values for ammonia during each of the month ranges and comparing the daily maximum values to the daily maximum limit. Based on this comparison, daily maximum limits are required year-round.

Ammonia Nitrogen mg/L	April - May	June - September	October - March
1-day P ₉₉	49	12	53
4-day P ₉₉	33	7.3	29
30-day P ₉₉	25	3.1	16
Mean*	21	1.2	11
Std	8.7	3.1	11
Sample size	35	79	124
Range	0.2 – 39	0.09 – 18	0.03 – 35

*Values lower than the level of detection were substituted with a zero

Where there are existing ammonia nitrogen limits in the permit, the limits must be retained regardless of reasonable potential, consistent with s. NR 106.33(1)(b), Wis. Adm. Code:

(b) If a permittee is subject to an ammonia limitation in an existing permit, the limitation shall be included in any reissued permit. Ammonia limitations shall be included in the permit if the permitted facility will be providing treatment for ammonia discharges.

Conclusions and Recommendations:

In summary, after rounding to two significant figures, the following ammonia nitrogen limitations are recommended.

	Daily Maximum mg/L	Monthly Average
Year – round	Variable	
March		29 mg/L 25 lbs/day

The current permit has a monthly average limit of 34 mg/L for the month of March, so a monthly limit is needed in the reissued permit. Because the calculated limit 29 mg/L is more stringent, this is recommended to be included in the reissued permit. **Per NR 106.32(5)(b), Wis. Adm. Code, mass limits are needed because the discharge is to an exceptional resource water.** The mass limit was calculated by: **design flow (0.105 MGD) x conc. limit (29 mg/L) x 8.34**. Additional limits to meet the requirements in s. NR 106.07, Wis. Adm Code, are addressed in the expression of limits section of this memo.

PART 4 - WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR BACTERIA

On May 1, 2020, revisions to chs. NR 102 and NR 210, Wis. Adm. Code became effective which replace fecal coliform limits with new *Escherichia coli* (*E. coli*) limits for protection of recreational uses. Section NR 210.06(2)(a)1, Wis. Adm. Code, includes two limits which must be included in permits for facilities which are required to disinfect:

1. The geometric mean of *E. coli* bacteria in effluent samples collected in any calendar month may not exceed 126 counts/100 mL.
2. No more than 10 percent of *E. coli* bacteria samples collected in any calendar month may exceed 410 counts/100 mL.

E. coli monitoring is recommended at the same frequency that fecal coliform monitoring is required in the current permit. Because Wild Rose's permit requires weekly monitoring, the 410 counts/100 mL limit will effectively function as a daily maximum limit unless the facility performs additional monitoring. Any additional monitoring beyond what is required by the permit must also be reported on the DMR as required in the standard requirements section of the permit.

These limits are required during May through September. No changes are recommended to the current recreational period and the required disinfection season.

Interim Limit

At this time, there is no effluent *E. coli* data available to determine if these limits are currently met. The permit will include a compliance schedule to meet these limits. During the compliance schedule, an interim limit applies to prevent back-sliding from the current level of disinfection during the compliance

schedule period. Therefore, the current **fecal coliform limit shall be included in the reissued permit as an interim limit of 400 counts/100 mL as a monthly geometric mean.**

PART 5 – PHOSPHORUS

Technology Based Phosphorus Limit

Subchapter II of Chapter NR 217, Wis. Adm. Code, requires municipal wastewater treatment facilities that discharge greater than 150 pounds of Total Phosphorus per month to comply with a monthly average limit of 1.0 mg/L, or an approved alternative concentration limit.

Because Wild Rose does not currently have an existing technology-based limit of 1.0 mg/L, the need for this limit in the reissued permit is evaluated. The data demonstrates that the annual monthly average phosphorus loading is less than 150 lbs/month, which is the threshold for municipalities in accordance to s. NR 217.04 (1) (a) 1, Wis. Adm. Code, and therefore no technology-based limit is required.

Month	Monthly Avg. mg/L	Total Flow MG/month	Total Phosphorus lb./mo.
Jan 2019	4.54	3.99	151
Feb 2019	4.98	3.53	147
Mar 2019	4.88	4.28	174
April 2019	4.26	4.60	164
May 2019	4.25	5.05	179
June 2019	3.47	4.29	124
July 2019	4.49	4.99	187
Aug 2019	5.08	3.32	141
Sept 2019	5.11	3.27	139
Oct 2019	4.47	3.71	138
Nov 2019	4.19	3.44	120
Dec 2019	4.09	3.30	112
Total			148

Total P (lbs/month) = Monthly average (mg/L) × total flow (MGD) × 8.34 (lbs/gallon)

Where total flow is the sum of the actual (not design) flow (in MGD) for that month

In addition, TMDL-derived WQBEL limits are needed for the Upper Fox and Wolf River Basin.

Water Quality-Based Effluent Limits (WQBEL)

Revisions to administrative rules regulating phosphorus took effect on December 1, 2010. These rule revisions include additions to ch. NR 102 (s. NR 102.06), which establish phosphorus standards for surface waters. Revisions to ch. NR 217 (s. NR 217, Subchapter III) establish procedures for determining WQBELs for phosphorus, based on the applicable standards in ch. NR 102.

The Department has developed a TMDL for the Upper Fox and Wolf River Basins which was approved by the US EPA in February 2020.

Section NR 217.16, Wis. Adm. Code, states that the Department may include a TMDL based limitation for phosphorus in addition to, or in lieu of, a s. NR 217.13 WQBEL in a WPDES permit. The UFWB TMDL establishes total phosphorus (TP) wasteload allocations (WLA) to reduce the loading in the entire watershed including WLAs to meet water quality standards for tributaries to the Upper Fox and Wolf

River. Therefore, WLA-based WQBELs are protective of immediate receiving waters and TP WQBELs derived according to s. NR 217.13, Wis. Adm. Code are not required

The current permit has a monthly average phosphorus limit of 2.9 mg/L (and 2.8 lbs/day) calculated based on the water quality criteria of 0.075 mg/L and a median background concentration of 0.014 mg/L.

Upper Fox Wolf TMDL

Total phosphorus (TP) effluent limits in lbs/day are calculated as recommended in the *TMDL Development and Implementation Guidance: Integrating the WPDES and Impaired Waters Programs* (April 2020) and are based on the annual phosphorus wasteload allocation (WLA) given in pounds per year. This WLA found in Appendix H of the *Total Maximum Daily Loads for Total Phosphorus and Total Suspended Solids in the Upper Fox and Wolf River Basins (UFWB TMDL)* report dated February 2020 are expressed as maximum annual loads (lbs/year). The annual WLA for Wild Rose is 60 lbs/year.

For the reasons explained in the April 30, 2012 paper entitled *Justification for Use of Monthly, Growing Season and Annual Average Periods for Expression of WPDES Permit Limits for Phosphorus Discharges in Wisconsin*, WDNR has determined that the phosphorus WQBELs set equal to WLAs would not be consistent with the assumptions and requirements of the TMDL. Therefore, limits given to continuously discharging facilities covered by the UFW TMDL are given monthly average mass limits and, if the equivalent effluent concentration is less than or equal to 0.3 mg/L, six-month average mass limits are also included. The following equation shows the calculation of equivalent effluent concentration:

$$\begin{aligned}\text{TP Equivalent Effluent Concentration} &= \text{WLA} \div (365 \text{ days/year} * \text{Flow Rate} * \text{Conversion Factor}) \\ &= 60 \text{ lbs/day} \div (365 \text{ days/year} * 0.105 \text{ MGD} * 8.34) \\ &= 0.19 \text{ mg/L}\end{aligned}$$

Since this value is less than 0.3 mg/L, both a six-month average mass limit and monthly mass limit are applicable for total phosphorus. The monthly average limit is set equal to three times the six-month average limit.

$$\begin{aligned}\text{TP Six-Month Average Permit Limit} &= \text{WLA} \div 365 \text{ day/year} * \text{multiplier} \\ &= 60 \text{ lbs/day} \div 365 \text{ days/year} * 1.14 \\ &= 0.188 \text{ lbs/day}\end{aligned}$$

$$\begin{aligned}\text{TP Monthly Average Permit Limit} &= \text{TP Six-Month Average Permit Limit} * 3 \\ &= 0.214 \text{ lbs/day} * 3 \\ &= 0.562 \text{ lbs/day}\end{aligned}$$

The multiplier used in the six-month average calculation was determined according to implementation guidance. A coefficient of variation (CV) was calculated, based on phosphorus mass monitoring data, to be 0.3. This was calculated by dividing the standard deviation of the phosphorus mass data by the average of the phosphorus mass data. This value, along with the monitoring frequency, is used to select the multiplier. The current permit specifies phosphorus monitoring as monthly. The reissued permit will have a phosphorus monitoring frequency of weekly, so this frequency was used for the calculation of the phosphorus limits. If a different monitoring frequency is used, the stated limits should be reevaluated.

Six-month average and monthly average mass effluent limits are recommended for this discharge. The limits are equivalent to a concentration of 0.214 mg/L and 0.642 mg/L respectively at the facility design flow of 0.105 MGD.

Since WLAs are expressed as annual loads (lbs/year), permits with TMDL-derived monthly average permit limits should require the permittee to calculate and report rolling 12-month sums of total monthly loads for TP. Rolling 12-month sums can be compared directly to the annual WLA of 60 lbs/year.

Effluent Data

The following table summarizes effluent total phosphorus monitoring data from 07/01/2015 to 12/31/2019.

	Phosphorus mg/L	Phosphorus lbs/day
1-day P ₉₉	7.9	5.2
4-day P ₉₉	6.3	3.9
30-day P ₉₉	5.4	3.2
Mean	4.9	2.9
Std	1.1	0.81
Sample size	233	233
Range	0.37 – 7.5	0.23 – 5.5

Interim limit

An interim limit is required per s. NR 217.17, Wis. Adm. Code, when a compliance schedule is needed in the permit to meet the WQBEL. The interim limit should reflect a concentration that the facility is able to meet without investing in additional “temporary” treatment, but also should prevent backsliding from current conditions. Because the current monthly average s. NR 217.13 WQBEL of 2.9 mg/L became effective January 1, 2020, and the 4-day P₉₉ and 30-day P₉₉ are higher than this, it is recommended that the interim limit be equivalent to the current monthly average limit. **The interim monthly average limit of 2.9 mg/L along with requirements for optimization are recommended to be included in the reissued permit.**

PART 6 – TOTAL SUSPENDED SOLIDS

Total Suspended Solids (TSS) effluent limits in lbs/day are calculated as recommended in the *TMDL Development and Implementation Guidance: Integrating the WPDES and Impaired Waters Programs* (April 2020). This WLAs found in Appendix I of the *Total Maximum Daily Loads for Total Phosphorus and Total Suspended Solids in the Upper Fox and Wolf Basins (UFWB TMDL)* report dated February 2020 are expressed as maximum annual loads (lbs/year). The annual WLA for Wild Rose is 21,386 lbs/year and the daily WLA is 59 lbs/day.

Revisions to chs. NR 106 and 205, Wis. Adm. Code align Wisconsin’s water quality-based effluent limits with 40 CFR 122.45(d), which requires WPDES permits contain the following concentration limits, whenever practicable and necessary to protect water quality:

- Weekly average and monthly average limitations for continuous discharges subject to ch. NR 210.
- Daily maximum and monthly average limitations for all other discharges.

Wild Rose Sanitary District is a municipal treatment facility and is therefore subject to weekly average and monthly average TSS limits derived from TSS annual WLAs.

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$$\begin{aligned}\text{TSS Weekly Average Permit Limit} &= \text{Daily WLA} * \text{Weekly multiplier} \\ &= 59 \text{ lbs/day} * 3.11 \\ &= 183 \text{ lbs/day}\end{aligned}$$

$$\begin{aligned}\text{TSS Monthly Average Permit Limit} &= \text{WLA} \div 365 \text{ days/year} * \text{Monthly multiplier} \\ &= 59 \text{ lbs/day} * 1.90 \\ &= 112 \text{ lbs/day}\end{aligned}$$

The multiplier used in the weekly average and monthly average calculation was determined according to implementation guidance. A coefficient of variation was calculated, based on TSS mass monitoring data, to be 0.81. However, it is believed that the optimization of the wastewater treatment system to achieve the WLA-derived permit limits will reduce effluent variability. Thus, the maximum anticipated coefficient of variation expected by the facility is 0.6. This value, along with monitoring frequency, is used to select the multiplier. The current permit specifies TSS monitoring as weekly; if a different monitoring frequency is used, the stated limits should be reevaluated.

Effluent Data

The following table summarizes effluent TSS monitoring data from 07/01/2015 to 12/31/2019.

	TSS mg/L	TSS lbs/day
1-day P ₉₉	37	25
4-day P ₉₉	22	14
30-day P ₉₉	14	8.6
Mean	10	6.1
Std	7.3	5.0
Sample size	236	236
Range	0 – 72	0.76 – 45

The effluent data from Wild Rose shows that the facility can currently meet the TMDL-derived TSS limits, therefore a compliance schedule is not needed, and the TMDL-derived limits should be effective upon permit reissuance. The concentration limits of 60 mg/L as a monthly average is recommended to continue in the reissued permit to prevent backsliding.

PART 7 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR THERMAL

Surface water quality standards for temperature took effect on October 1, 2010. These regulations are detailed in chs. NR 102 (Subchapter II – Water Quality Standards for Temperature) and NR 106 (Subchapter V – Effluent Limitations for Temperature) of the Wisconsin Administrative Code. Daily maximum and weekly average temperature criteria are available for the 12 different months of the year depending on the receiving water classification.

In accordance with s. NR 106.53(2)(b), Wis. Adm. Code, the highest daily maximum flow rate for a calendar month is used to determine the acute (daily maximum) effluent limitation. In accordance with s. NR 106.53(2)(c), Wis. Adm. Code, the highest 7-day rolling average flow rate for a calendar month is

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used to determine the sub-lethal (weekly average) effluent limitation. These values were based off actual flow reported from 07/01/2015-02/29/2020.

The table below summarizes the maximum temperatures reported during monitoring from August and September 2013. The previous WQBEL memo recommended thermal limits for the months of August and September subject to drop so the Wild Rose submitted thermal data for these two months only so the limits were dropped.

Month	Representative Highest Monthly Effluent Temperature		Calculated Effluent Limit	
	Weekly Maximum	Daily Maximum	Weekly Average Effluent Limitation	Daily Maximum Effluent Limitation
	(°F)	(°F)	(°F)	(°F)
JAN			NA	120
FEB			NA	120
MAR			NA	120
APR			NA	120
MAY			NA	120
JUN			NA	120
JUL			104	120
AUG	76.3	77.0	93	120
SEP	73.3	74.8	94	120
OCT			95	120
NOV			NA	120
DEC			NA	120

Reasonable Potential

Permit limits for temperature are recommended based on the procedures in s. NR 106.56, Wis. Adm. Code.

- An acute limit for temperature is recommended for each month in which the representative daily maximum effluent temperature for that month exceeds the acute WQBEL. The representative daily maximum effluent temperature is the greater of the following:
 - (a) The highest recorded representative daily maximum effluent temperature
 - (b) The projected 99th percentile of all representative daily maximum effluent temperatures
- A sub-lethal limitation for temperature is recommended for each month in which the representative weekly average effluent temperature for that month exceeds the weekly average WQBEL. The representative weekly average effluent temperature is the greater of the following:
 - (a) The highest weekly average effluent temperature for the month.
 - (b) The projected 99th percentile of all representative weekly average effluent temperatures for the month

The effluent data for August and September show no reasonable potential for exceeding the weekly average limits.

Data is not available for the remaining months of the year however at temperatures above ~103°F, conventional biological treatment systems stop functioning properly and experience upsets. There is no indication that this has ever occurred at this treatment system. This information, coupled with the lack of significant industrial heat load, lead to the conclusion that there is no reasonable potential for the discharge to exceed the 120°F limitation for the months of November – June or exceed the 104°F limitation for the month of July. In addition, s. NR 106.59(2)(b), Wis. Adm. Code, allows the use of temperature effluent data, on a case-by-case basis, from at least two other POTWs within a 100-mile radius that utilize similar wastewater treatment technology and have a similar ratio of domestic to industrial waste stream composition, or representative data of the POTW. Based on this information, there is no reasonable potential to exceed any of these limits. No limit is recommended to be included in the reissued permit for temperature.

Temperature limits or monitoring are not recommended to be included in the reissued permit.

PART 8 – WHOLE EFFLUENT TOXICITY (WET)

WET testing is used to measure, predict, and control the discharge of toxic materials that may be harmful to aquatic life. In WET tests, organisms are exposed to a series of effluent concentrations for a given time and effects are recorded. Decisions below related to the selection of representative data and the need for WET limits were made according to ss. NR 106.08 and 106.09, Wis. Adm. Code. WET monitoring frequency and toxicity reduction evaluation (TRE) recommendations were made using the best professional judgment of staff familiar with the discharge after consideration of the guidance in the WET Program Guidance Document (October 29, 2019).

- Acute tests predict the concentration that causes lethality of aquatic organisms during a 48 to 96-hour exposure. To assure that a discharge is not acutely toxic to organisms in the receiving water, WET tests must produce a statistically valid LC₅₀ (Lethal Concentration to 50% of the test organisms) greater than 100% effluent, according to s. NR 106.09 (2) (b), Wis. Adm Code.
- Chronic tests predict the concentration that interferes with the growth or reproduction of test organisms during a seven-day exposure. To assure that a discharge is not chronically toxic to organisms in the receiving water, WET tests must produce a statistically valid IC₂₅ (Inhibition Concentration) greater than the instream waste concentration (IWC), according to s. NR 106.09 (3) (b), Wis. Adm Code. The IWC is an estimate of the proportion of effluent to total volume of water (receiving water + effluent). The IWC of 8% shown in the WET Checklist summary below was calculated according to the following equation, as specified in s. NR 106.03(6), Wis. Adm Code:

$$\text{IWC (as \%)} = Q_e \div \{(1 - f) Q_e + Q_s\} \times 100$$

Where:

Q_e = annual average flow = 0.105 MGD = 0.162 cfs

f = fraction of the Q_e withdrawn from the receiving water = 0

Q_s = 1/4 of the 7- Q_{10} = 7.40 cfs ÷ 4 = 1.85 cfs

- According to the *State of Wisconsin Aquatic Life Toxicity Testing Methods Manual* (s. NR 219.04, Table A, Wis. Adm. Code), a synthetic (standard) laboratory water may be used as the dilution water and primary control in acute WET tests, unless the use of different dilution water is approved by the Department prior to use. The primary control water must be specified in the WPDES permit.

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- According to the *State of Wisconsin Aquatic Life Toxicity Testing Methods Manual* (s. NR 219.04, Table A, Wis. Adm. Code), receiving water must be used as the dilution water and primary control in chronic WET tests, unless the use of different dilution water is approved by the Department prior to use. The dilution water used in WET tests conducted on Outfall 002 shall be a grab sample collected from the receiving water location, upstream and out of the influence of the mixing zone and any other known discharge. The specific receiving water location must be specified in the WPDES permit.
- Shown below is a tabulation of all available WET data for Outfall 002. Efforts are made to ensure that decisions about WET monitoring and limits are made based on representative data, as specified in s. NR 106.08 (3), Wis. Adm. Code. Data which is not believed to be representative of the discharge was not included in reasonable potential calculations. The table below differentiates between tests used and not used when making WET determinations. Significant changes were made to WET test methods in 2004 and these changes were assumed to be fully implemented by certified labs by no later than June 2005. Data was excluded before June 2005 for this analysis.

WET Data History

Date Test Initiated	Acute Results LC ₅₀ % (% survival in 100% effluent)				Chronic Results IC ₂₅ %				Footnotes or Comments
	<i>C. dubia</i>	Fathead minnow	Pass or Fail?	Used in RP?	<i>C. dubia</i>	Fathead Minnow	Pass or Fail?	Use in RP?	
10/04/2005	>100	>100	Pass	Yes	>100	>100	Pass	Yes	
09/12/2006	>100	>100	Pass	Yes	>100	>100	Pass	Yes	
05/28/2009	>100	>100	Pass	No	>100	>100	Pass	No	1
01/12/2016	>100	>100	Pass	Yes	>100	>100	Pass	Yes	
11/07/2017	>100	>100	Pass	Yes	>100	>100	Pass	Yes	

Footnotes:

- Tests done by S-F Analytical, July 2008 – March 2011.* The DNR has reason to believe that WET tests completed by SF Analytical Labs from July 2008 through March 31, 2011 were not performed using proper test methods. Therefore, WET data from this lab during this period has been disqualified and was not included in the analysis.
- According to s. NR 106.08, Wis. Adm. Code, WET reasonable potential is determined by multiplying the highest toxicity value that has been measured in the effluent by a safety factor, to predict the likelihood (95% probability) of toxicity occurring in the effluent above the applicable WET limit. The safety factor used in the equation changes based on the number of toxicity detects in the dataset. The fewer detects present, the higher the safety factor, because there is more uncertainty surrounding the predicted value. **WET limits must be given, according to s. NR 106.08(6), Wis. Adm. Code, whenever the applicable Reasonable Potential equation results in a value greater than 1.0.**

$$\text{Acute Reasonable Potential} = [(TUa \text{ effluent}) (B)(AMZ)]$$

$$\text{Chronic Reasonable Potential} = [(TUC \text{ effluent}) (B)(IWC)]$$

According to s. NR 106.08(6)(d), Wis. Adm. Code, TUa and TUC effluent values are equal to zero whenever toxicity is not detected (i.e. when the LC₅₀, IC₂₅ or IC₅₀ ≥ 100%).

Acute Reasonable Potential = 0 < 1.0, reasonable potential is not shown, and a limit is not required.

Chronic Reasonable Potential = 0 < 1.0, reasonable potential is not shown, and a limit is not required.

The WET Checklist was developed to help DNR staff make recommendations regarding WET limits, monitoring, and other related permit conditions. The Checklist indicates whether acute and chronic WET

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limits are needed, based on requirements specified in s. NR 106.08, Wis. Adm. Code. The Checklist steps the user through a series of questions, assesses points based on the potential for effluent toxicity, and suggests monitoring frequencies based on points accumulated during the Checklist analysis. As toxicity potential increases, more points accumulate, and more monitoring is recommended to ensure that toxicity is not occurring. A summary of the WET Checklist analysis completed for this permittee is shown in the table below. Staff recommendations based on best professional judgment are provided below the summary table. For guidance related to reasonable potential and the WET Checklist, see Chapter 1.3 of the WET Guidance Document: <http://dnr.wi.gov/topic/wastewater/WETguidance.html>.

WET Checklist Summary

	Acute	Chronic
AMZ/IWC	Not Applicable. 0 Points	IWC = 8%. 0 Points
Historical Data	4 tests used to calculate RP. No tests failed. 0 Points	4 tests used to calculate RP. No tests failed. 0 Points
Effluent Variability	Little variability, no violations or upsets, consistent WWTF operations. 0 Points	Same as Acute. 0 Points
Receiving Water Classification	Exceptional Resource Water 12 Points	Same as Acute. 12 Points
Chemical-Specific Data	Limit for ammonia nitrogen (and RP for limit) based on ATC; chloride, copper, lead, and nickel detected. Additional Compounds of Concern: 0 8 Points	No limits based on CTC; chloride, copper, lead, and nickel detected. Additional Compounds of Concern: 0 3 Points
Additives	P treatment chemical other than Ferric Chloride (FeCl ₃), Ferrous Sulfate (FeSO ₄), or alum used: No 0 Points	All additives used more than once per 4 days. 0 Points
Discharge Category	One Industrial Contributor. 5 Points	Same as Acute. 5 Points
Wastewater Treatment	Secondary treatment 0 Points	Same as Acute 0 Points
Downstream Impacts	No impacts known 0 Points	Same as Acute. 0 Points
Total Checklist Points:	25 Points	20 Points
Recommended Monitoring Frequency (from Checklist):	3 tests during permit term (year 1, 3, 5, etc.)	2 tests during permit term (year 2, 4, 6, etc.)
Limit Required?	No	No
TRE Recommended? (from Checklist)	No	No

- After consideration of the guidance provided in the Department's WET Program Guidance Document (2019) and other information described above three acute and two chronic WET tests are recommended in the reissued permit. Tests should be done in rotating quarters to collect seasonal information about this discharge. WET testing should continue after the permit expiration date (until the permit is reissued).

PART 9 – EXPRESSION OF LIMITS

Revisions to chs. NR 106 and 205, Wis. Adm. Code align Wisconsin's water quality-based effluent limits with 40 CFR 122.45(d), which requires WPDES permits contain the following concentration limits, whenever practicable and necessary to protect water quality:

- Weekly average and monthly average limitations for continuous discharges subject to ch. NR 210.
- Daily maximum and monthly average limitations for all other discharges.

Wild Rose is a municipal treatment facility and is therefore subject to weekly average and monthly average limitations whenever limitations are determined to be necessary.

This evaluation provides additional limitations necessary to comply with the expression of limits in ss. NR 106.07 and NR 205.065(7), Wis. Adm. Code. Pollutants already compliant with these rules or that have an approved impracticability demonstration, are excluded from this evaluation including water-quality based effluent limitations for phosphorus, temperature, and pH, among other parameters. Mass limitations are not subject to the limit expression requirements if concentrations limits are given.

Method for calculation:

The methods for calculating limitations for continuous discharges subject to ch. NR 210 to conform to 40 CFR 122.45(d) are specified in s. NR 106.07(3), Wis. Adm. Code, and are as follows:

1. Whenever a daily maximum limitation is determined necessary to protect water quality, a weekly and monthly average limitation shall also be included in the permit and set equal to the daily maximum limit unless a more restrictive limit is already determined necessary to protect water quality.
 - Ammonia nitrogen – There are daily maximum limits in the current permit that are recommended to continue in the reissued permit. Because there are daily maximum limits recommended, weekly and monthly average limits are also needed. The calculated limits from Part 4 for each season are recommended to be included in the reissued permit. The summary of these limits is shown in the table below.
2. Whenever a weekly average limitation is determined necessary to protect water quality, a monthly average limitation shall also be included in the permit and set equal to the weekly average limit unless a more restrictive limit is already determined necessary to protect water quality.
3. Whenever a monthly average limitation is determined necessary to protect water quality, a weekly average limit shall be calculated using the following procedure and included in the permit unless a more restrictive limit is already determined necessary to protect water quality:

$$\text{Weekly Average Limitation} = (\text{Monthly Average Limitation} \times \text{MF})$$

Where:

MF= Multiplication factor as defined in Table 1

CV= coefficient of variation (CV) as calculated in s. NR 106.07(5m)

n= the number of samples per month required in the permit

s. NR 106.07 (3) (e) 4. Table 1 — Multiplication Factor (for CV = 0.6)

CV	n=1	n=2	n=3	n=4	n=8	n=12	n=16	n=20	n=24	n=30
0.6	1.00	1.31	1.51	1.64	1.95	2.12	2.23	2.30	2.36	2.43

Note: This methodology is based on the *Technical Support Document for Water Quality-based Toxics Control* (March 1991). PB91-127415.

Summary of Additional Limitations:

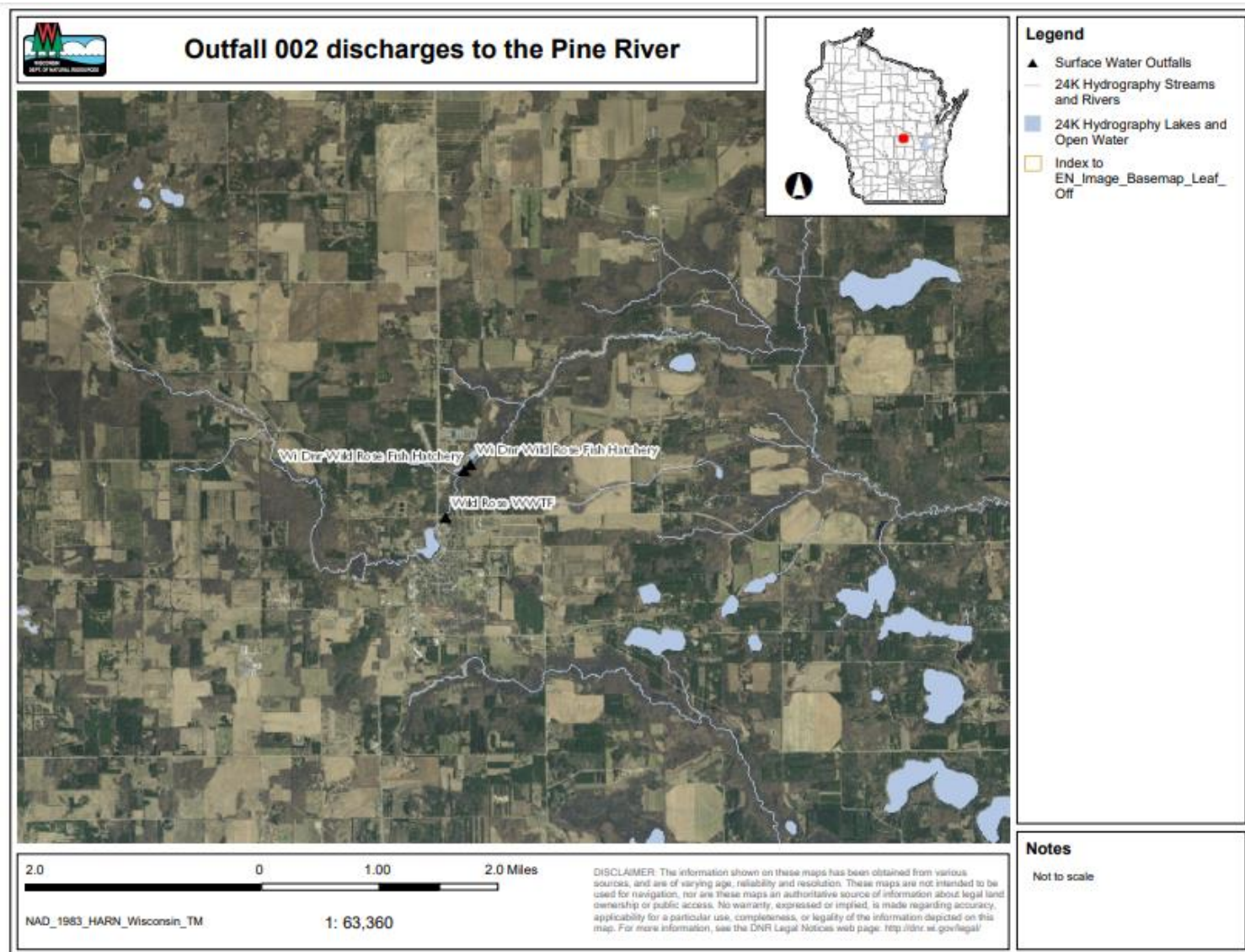
In conclusion, the following additional limitations are required to comply with ss. NR 106.07 and NR 205.065(7) Expression of Limits.

Parameter	Daily Maximum	Weekly Average	Monthly Average
Ammonia Nitrogen			
April & May	Variable	68 mg/L 60 lbs/day	26 mg/L 23 lbs/day
June – Sept.	Variable	72 mg/L 63 lbs/day	72 mg/L 63 lbs/day
Oct. – March	Variable	72 mg/L 63 lbs/day	29 mg/L 25 lbs/day

Ammonia Nitrogen

The permit contains pH variable daily maximum limits and the highest daily maximum limit allowed dependent on pH is more restrictive than the calculated weekly and monthly average limits. Therefore, **monthly and weekly average limits of 72 mg/L are recommended in the permit for the months of June – September and a weekly average limit of 72 mg/L is recommended in the permit for the months of October – March.** The corresponding mass limits are calculated based on: design flow (0.105 MGD) x conc. limit x 8.34.

Attachment #2



Attachment #3

Temperature limits for receiving waters with unidirectional flow

(calculation using default ambient temperature data)

Facility:	Wild Rose	7-Q₁₀:	7.40	Flow Dates
Outfall(s):	002	Dilution:	25%	07/01/15
Date Prepared:	04/10/2020	f:	0	02/29/20
Design Flow (Q_e):	0.11 MGD	Stream type:		
Storm Sewer Dist.	0 ft	Qs:Q_e ratio:	11.4	
		Calculation Needed?	YES	

Month	Water Quality Criteria			Receiving Water Flow Rate (Qs) (cfs)	Representative Highest Effluent Flow Rate (Q _e)		f	Calculated Effluent Limit	
	T _a (default)	Sub-Lethal WQC	Acute WQC		7-day Rolling Average (Q _{esl})	Daily Maximum Flow Rate (Q _{ea})		Weekly Average Effluent Limitation	Daily Maximum Effluent Limitation
	(°F)	(°F)	(°F)		(MGD)	(MGD)		(°F)	(°F)
JAN	35	47	68	7.40	0.072	0.087	0	NA	120
FEB	36	47	68	7.40	0.074	0.086	0	NA	120
MAR	39	51	69	7.40	0.089	0.116	0	NA	120
APR	47	57	70	7.40	0.092	0.102	0	NA	120
MAY	56	63	72	7.40	0.091	0.107	0	NA	120
JUN	62	67	72	7.40	0.096	0.124	0	NA	120
JUL	64	67	73	7.40	0.097	0.113	0	104	120
AUG	63	65	73	7.40	0.085	0.107	0	93	120
SEP	57	60	72	7.40	0.104	0.123	0	94	120
OCT	49	53	70	7.40	0.114	0.122	0	95	120
NOV	41	48	69	7.40	0.090	0.099	0	NA	120
DEC	37	47	69	7.40	0.089	0.102	0	NA	120